## Real Physics: Three Statements

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## Statement 1: Real Physics is Essential to Graphics

## Graphics "Rediscovery" of Physics

- Light
- Kinematics & Dynamics
- Fluid Mechanics
- Solid Mechanics

...

$\tau = \mu \, du/dy$

## "Rediscovery" is necessary:

- Tech transfer: physics graphics terms
- Demonstrate application of concepts
- Simplification to computationally tractable models

## Role of Physical Models in Graphics Applications

- **Image as end product:** *feature films, games,art*
  **Physical models a useful starting point.**
- **Image a means to and end:** *design, simulation*
  **Physical models are essential.**

## What Physical Models Provide:

**Compact representation:**
parametric functions rather than masses of data

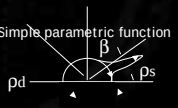
**BRDF**

Thousands of data points

| qi | fi | qo | fo | f |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | .0001 |
| 0 | 5 | 0 | 0 | .0001 |
| 0 | 10 | 0 | 0 | .00022 |
| ... | | | | |
| 85 | 175 | 5 | 10 | .0011 |

vs.

Simple parametric function

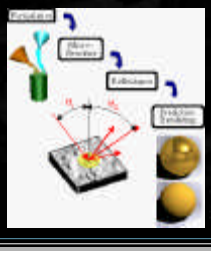


## What Physical Models Provide:

Parameters: natural to change
Useful when image is the end product


## What Physical Models Provide:

Reliable Predictions
Essential when image is a means to an end
e.g. Design of coatings



NIST
Appearance
Project

## Statement 2:
## Physics "Rediscovery" for Graphics is Complete

## "Rediscovery" is finished:

- All the major physical disciplines have been explored
- Major breakthroughs aren't needed to make use of models from other disciplines

## "Rediscovery" is finished:

- The goal of graphics is not perfectly accurate physics, we don't need to account for every photon.
- The goal of graphics is the perfect image. What would that be???

## Statement 3:
## Perceptual Models are Needed to Apply Physics

## Physical Models: Big Impact when Image is the End Product : films, games

- Author Decides "Good Enough"
- A Lot of Time + Money

## Physical Models Small Impact when Image is the Means to an End:

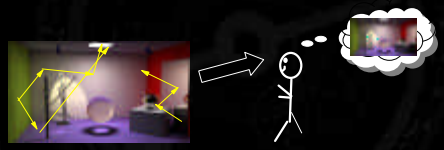
Design, Simulation

- Image Must Be Visually Accurate
- Scarce Time + Money

G. Ward
*Radiance*

## Making Reliable Images Inexpensively:

Physical Model + Perceptual Model



- Insures that physical model is accurate enough
- Prevents modeling every atom & photon

## Successful Perceptual Models:

- Tristimulus Model
- Tone Mapping

## Some of the Outstanding Issues:

- Geometry
- Reflectance
- Motion

## 1. Real Physics is Essential to Graphics

## 2. Physics "Rediscovery" for Graphics is Complete

## 3. Perceptual Models are Needed to Apply Physics